REMARKS

This Amendment is submitted in response to the non-final Office Action dated April 7, 2005, wherein the "formal" drawings submitted in response to the "Notice to File Corrected Application Papers" were objected to as being improperly labeled, pending claims 1 – 7 were rejected as "obvious" over a single prior art reference, and claims 8 – 34 were withdrawn pursuant to an earlier Restriction Requirement. Applicant is hereby resubmitting the same formal drawings with corrected labeling. Applicant traverses the rejection of claims 1 – 7, as described below. Claims 1 – 7 remain pending and claims 8 – 34 are withdrawn. Reexamination and reconsideration in view of the following remarks are respectfully requested.

Drawings

In response to the examiner's objection to the drawings, Applicant is submitting a new set of formal drawings which are identical to the drawings submitted on March 2, 2005 (received by the USPTO on or about March 7, 2005), except that each of the drawings now contains the label "Replacement Sheet" as required by the examiner. It is noted that the drawings have ***not*** been amended.

Traversal of Rejection

Pending claims 1 – 7 were rejected under 35 U.S.C. § 103(a) as obvious over the commonly owned patent to Yoshimura et al., U.S. Pat. No. 6,684,007 ("Yoshimura"). Applicant respectfully traverses this rejection. Yoshimura does not disclose or suggest a *flexible* strip having a *plurality* waveguide layers having a *plurality* of optical paths *between opposing ends of the flexible strip* where at least one of the optical paths is routed in *at least two waveguide* ***layers.***

It is important to note that claim 1 includes both waveguides and waveguide layers as distinct elements. These are different structures. A waveguide layer may have multiple individual waveguides formed therein. Thus, for example, the embodiment depicted in FIG. 3 of the present application shows two waveguide layers 301 and 305, as described in paragraphs **[0036] – [0038]** of the application. (It is further noted that a waveguide "layer" may comprise a core layer and one or more cladding layers as necessary for optical confinement.)

While Yoshimura discloses many embodiments of opto-electronic substrates and structures for interconnecting electrical and optical components, including embedded structures for converting electrical signals to optical signals and vice versa, it addresses different problems and concerns that those that are addressed by the present invention. Specifically, the present invention is generally concerned with an optical backplane, which may be entirely passive, that is capable of high density, complex optical signal routing. In order to achieve this result, the present invention uses multiple waveguide layers to allow optical paths to cross over (or under) each other to facilitate a high density of complex optical signal routing. While Yoshimura shows backplane structures, it does not show or suggest routing optical signals between ends of a flexible strip, where at least one optical signal path is routed within multiple waveguide layers. The fact that this problem of complex optical signal routing is not mentioned in the extensively comprehensive disclosure of the Yoshimura patent suggests that it was not considered by the inventors. Clearly, the Yoshimura inventors tried to describe as many different embodiments as they could. Yet they did not disclose or suggest optical paths that are routed in multiple waveguide layers or that cross over (or under) each other using multiple waveguide layers.

The examiner refers to the following portions of Yoshimura as pertinent to claim 1: (1) col. 6,[1] second paragraph; (2) col. 3, first paragraph; and (3) col. 5, line 58 – col. 6. The passages references in items (1) and (3) refer to multiple waveguide structures that are formed in a **single waveguide layer.** Neither of these passage show or suggest a structure having **multiple waveguide layers**, and the figures they refer to also show only one waveguide layer. The passage referenced in item (2) is merely a generalized statement which does not show or suggest any particular structure.

Because Yoshimura is so complex, Applicant believes it would be useful to specifically discuss Yoshimura's disclosed embodiments, as reflected in the figures of the patent:

FIGS. 1 – 20 do not show or suggest multiple waveguide layers, the substrates shown in these figures are not said to be flexible, and the figures do not show or suggest multiple optical

[1] Page 4 of the Office Action refers to "col. 66." This is understood to mean column 6, insofar as there is no column 66.

paths extending between ends of a flexible strip. This embodiment is for a much different applications than the present invention.

FIGS. 21 – 30 show an optical substrate 20, of the type depicted in FIG. 1, mounted on a non-flexible base substrate (motherboard) 120. Therefore, these structures are different on the same bases as those of FIGS. 1 – 20. There is no reason to make substrate 20 or substrate 120 flexible because various IC chips and other components are mounted thereon.

FIGS. 31 – 32-1 show an optical strip 20 mounted on a rigid substrate 12 connecting to a backplane 210 mounted on a rigid substrate 212. The optical strip has only one waveguide layer, and the backplane has only one waveguide layer 120.

FIGS. 33 – 45, and 109 show rigid chip modules, which may be stacked, where each optical strip has only one waveguide layer, and a method for fabricating such modules. There is no suggestion of complex light path routing using multiple waveguide layers within a single substrate.

FIGS. 46 – 68-2, 74 – 108 and 147 – 153 show fabrication techniques making various types of optical strips having only one waveguide layer. Even if the techniques of these figures were extended to fabricate a device having multiple waveguide layers, there is no teaching, suggestion or motivation for routing an optical path in two waveguide layers.

FIGS. 69 – 73 show additional rigid, stacked multichip module configurations, with z-axis optical paths formed at the edges of the stacked substrates. Each of the stacked substrates has only one waveguide layer.

FIGS. 110 and 111 show stacked multichip module configurations where at least some of the rigid optical substrates in the stack appear to include more than one optical waveguide layer. There is no indication that there are any optical paths formed which are routed through multiple waveguide layers, nor are any optical paths shown which extend between opposing ends of the optical substrate.

FIGS. 112 – 116 show isolated layers that can be used in stacked modules. None of these figures show a strip having plural waveguide layers, nor do any of them show a single waveguide that extends between opposing ends of the strip.

FIGS. 117 – 123, 125, 126, 130 – 134 and 136 – 138 show chip modules comprising an optical strip, which may be mounted on an electrical board or other substrate, and having chips or chip holding substrates mounted thereon. Some of the depicted embodiments show an optical strip having multiple waveguide layers, but none show an optical path that extends between opposing ends of the optical strip or an optical path which is routed through more than one waveguide layer. In the Office Action, the examiner points to Yoshimura's FIGS. 131 and 132 as showing an optical path running through at least two layers.[2] Applicant respectfully disputes this assertion. Although Yoshimura's FIGS. 130 and 131 show two waveguide layers, the optical paths that are shown each run through only one layer, and then are diverted in the z-axis direction out of the waveguide layer. Thus, these figures do not show an optical path that is routed along multiple waveguide layers, as required by the pending claims of the present application. As used in the present application, the z-axis deflection of the optical path in Yoshimura is a pass through – *i.e.,* it passes the optical signal in the z direction through the overlying layers in the substrate. It is further noted that the optical paths depicted in FIGS. 131 and 132 do not extend between the opposing ends of the optical strip. Rather, they are used to direct optical signals to and from devices that are mounted on the strip.

FIG. 124 shows an optical strip, of the type previously described, having cut ends that are twisted and configured to form a two-dimensional optical connector. No details of the structure of the optical strip are shown in this figure.

---

[2] In the key paragraph on page 4 of the Office Action, beginning on line 10 ("Regarding claim 1, ...) the examiner first refers to FIGS. 130 and 131, and later refers to FIGS. 31 and 32. It is believed that the reference to FIGS. 31 and 32 was a mistake and was, instead, intended to be a reference to FIGS. 131 and 132. FIGS. 31 and 32 show only a single optical waveguide layer in optical substrate 20 and a single optical waveguide layer in the optical portion of the motherboard substrate 120, and, therefore, appear to be less pertinent than what is shown in FIGS. 130 – 132. Clearly if there is only one waveguide layer, the optical path cannot be routed in multiple waveguide layers, as required by claim 1. Moreover, the examiner has not shown any suggestion or motivation for combining the structure depicted in FIGS. 31 and 32 with the structures depicted in FIGS. 130 and 131.

FIG. 127 shows a plan view of a substrate of the optical substrate of FIG. 126, adapted for use with commercially available connectors.

FIGS. 128 and 129 show details of the structure for electrically and optically connecting a VCSEL to an optical strip having one waveguide layer.

FIG. 135 shows a plurality of chip modules attached to a rigid, z-axis backplane. The module substrates and the backplane each have two optical waveguide layers. However, there is no disclosure or suggestion of multiple optical paths extending between opposing ends of an optical strip having an optical path that is routed in more than one waveguide layer.

FIGS. 141 and 142 show rigid interposer structures including embedded VCSELS with IC chips mounted thereon for "smart pixel" applications.

FIGS. 143 – 146 show motherboard substrates having multiple optical waveguide layers, on which the previously described optical strips are mounted. The disclosed motherboard substrates do not depict or suggest multiple optical paths extending between opposing ends of the substrate and having an optical path that is routed in more than one waveguide layer.

It is noted that many of the structures described in Yoshimura, and depicted in the drawings of the patent, are intended for different applications. It is submitted that it would be improper to combine various features and structures shown in the different embodiments absent a suggestion or motivation for doing so. Thus, the features of the various embodiments of stacked substrates would not be applicable to backplanes, and those of ordinary skill in the art would not be motivated to combine them even though they appear in a single reference. Nonetheless, no combination of the features and structures of the various embodiments in Yoshimura show or suggest routing an optical path between opposing ends of a flexible strip in multiple waveguide layers.

Regarding dependent claim 2, Yoshimura does not depict a pass through which is used to route light from a first waveguide layer into a second waveguide layer.

Regarding dependent claim 3, Yoshimura does not show the use of a complementary pair of reflective angled surfaces for deflecting light from a first waveguide layer into a second

waveguide layer, where one of the pair is in each of the two layers. The examiner states that this is shown in FIGS. 146 and 105. Applicant respectfully points out that FIG. 146 does not show complementary reflective surfaces in two waveguide layers. Indeed, FIG. 146 does not show any optical signals being routed from one waveguide layer to another. FIG. 105 is a plan view showing a single reflective surface (rather than a pair) that is used to change the direction of light *within* a waveguide layer. It does not show a reflective surface being used to route an optical signal from one waveguide *layer* to another.

Regarding claim 5, Yoshimura does not show an optical connector, as recited in claim 1, mounted on a backplane substrate, with a mounting structure for at least two optical circuit boards. The examiner refers to FIGS. 31 and 32 and depicting this. However, the backplane substrate 210 in FIGS. 31 and 32 comprises only one optical waveguide layer, and there is no indication or suggestion that the optical backplane substrate requires complex routing. Indeed, all of the optical paths shown, for example, in FIG. 31, extend straight across the substrate.

Regarding claim 7, Yoshimura does not show or suggest optical paths that cross over. The examiner points to FIG. 144 as showing optical paths that cross over. Applicant respectfully disagrees. FIG. 144 shows optical paths that pass through other layers, but not paths that cross over other layers.

Other Prior Art

In the Office Action the examiner identifies a number of other prior art references which are said to be "pertinent" but which are not relied upon to reject any of the claims. These references do not appear to be any more pertinent than Yoshimura. Specifically, it is submitted that none of them teach or suggest a flexible optical strip having multiple waveguide layers and multiple optical paths extending between opposing ends of the strip, wherein at least one optical path is routed in more than one waveguide layer.

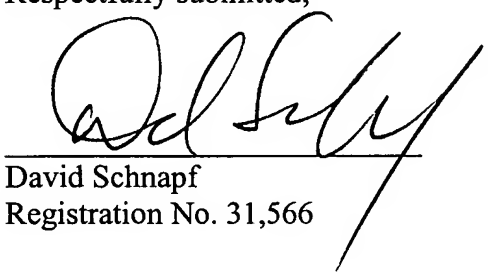
Conclusion

In view of the foregoing comments, it is respectfully submitted that the application is in condition for allowance, and such action is earnestly solicited. The examiner is invited to call the

undersigned at the telephone number listed below if doing so might advance the prosecution of this application.

June 15, 2005

Respectfully submitted,



David Schnapf
Registration No. 31,566

Sheppard Mullin Richter & Hampton LLP
4 Embarcadero Center, 17th Floor
San Francisco, CA 94111-4106
Tel: (415) 434-9100
Fax: (415) 434-3947